PATENT SPECIFICATION

1,026,341

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Int. Cl.:—**B 23 b** // B01f, B24b, F02b, H02k.

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Improvements relating to Power-Operated Tools

I, JOHN HENRY PIERCE, a British Subject, of 150, Widney Road, Bentley Heath, Solihull, in the County of Warwick, do hereby decdare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and bv the following statement:—

This invention relates to power-operated tools, of the kind comprising a unit of a size to be hand held by an operator and having an output shaft which may be provided with a chuck, driving-dog or other means enabling driving connection to be made to any of a number of tool bits or appliances, for example hedge-cutting implements, drill bits, mixing paddles, sanding heads, or small electrical generators connected to lamp units so as to provide portable searchlights.

Tools of this kind are in widespread use and almost universally utilise fractional horse-power electric motors connected to mains electricity supplies by current conducting cables. For various practical reasons these tools are limited in that they can only be used within a small radius of an electrical supply source. Tools of this kind are also known, which utilise other kinds of motors, but in general they all suffer from the same or similar limitations.

The object of the present invention is primarily to provide a tool not so limited.

In accordance with one aspect of the invention, a portable self-powered pivotal grip hand tool having an output shaft adapted to be connected to any one of a range of tool-bits or appliances comprises a casing having a handle for carrying and directing the tool, a compression-ignition two-stroke engine disposed in the casing and having its output shaft connected to the output shaft of the tool and a fuel tank connected to the engine through a control valve.

Hence, the tool carries its own power source with it, and can be used without limitation from this aspect.

Preferably the engine is of about 5 c.c. capacity. Such an engine may produce a continuous power output of about ½ h.p. which is well comparable with that produced by the more conventional 375 watt electric motor used in portable electrically operated tools.

Means may be provided to enable the motor to run at any angle of inclination, in any direction, and the principal problem in this connection is that of fuel supply.

In accordance with another aspect of the invention therefore, an internal combusion engine in a portable self-powered hand tool is connected to a flexible and collapsible fuel tank adapted to be completely filled with fuel and sealed, apart from the engine connection which includes a metering valve, so that fuel induction is effected by suction at the engine and is not substantially dependent upon gravity or upon flow of air into the tank to replace used fuel.

Preferably the tank is disposed in a casing vented to atmosphere, and the engine connection comprises an inlet tube in the tank having a wire or other baffle surrounding at least the inlet port to the tube to prevent the tank, when collapsed, from sealing over the port.

To simplify the engine as far as possible, it is conveniently air-cooled and has cooling fins on the cylinder barrel and head, air inlets and outlets in the casing housing the engine, and an output shaft driven fan or impeller inducing air flow through the casing about the fins.

In accordance with another aspect of the invention, a starter device is mounted on the

engine output shaft comprising a pinion loose on the shaft engagable with free-wheel pawls fixed relative to the shaft, the pinion being rotatable by a hand-pulled cable port via pulley secured to the pinion.

Preferably the pulley is returnable by a clock-spring tensioned during pulling of the cable.

One embodiment of the invention is now described by way of example and with reference to the accompanying drawings, wherein:—

Figure 1 is a perspective view of a complete portable tool;

Figure 2 is a plan view of a fuel tank assembly of the tool;

Figure 3 is an elevation of the tool with parts removed for clarity;

Figures 4, 5 and 6 are sections on the lines 4-4, 5-5 and 6-6 of Figure 3; and

Figure 7 is a section on the line 7-7 of Figure 6.

Referring to the drawings, and initially to Figure 1 thereof, the tool shown therein is generally pistol shaped and comprises a handle 10 secured to a casing by screws 11. The casing comprises two similar shells 12, 13, meeting along the median plane of the tool and held together by a series of screws passing into holes 14 (see Figure 3) and also by the handle 10, tank bracket 15, and bearing plate 16 and front housing 17 which all span the shells, the plate and housing 16, 17 being held in place by screws 18 passing into the shells.

At the rear of the casing is a cylinder container 19 clamped to the shells by the tank bracket 15 and having an air vent 20 in its base: the container houses the fuel tank, see Figure 2. The tank comprises a plastics bag 21, shown in the Figure as a transparent bag although this is of course not essential and is done to enable the interior to be seen. The mouth of the bag is sleeved over a head piece 22, a rubber grommet 23 is disposed around the mouth, and a wire clip 24 engages around the grommet and holds the bag in fluid-tight contact with the head-piece. The latter is insertable with the bag into the container 19, and has a flange 25 to seat on the rim of the container. Two holes open through the head-piece, and a tapped filling plug 26 closes one: the other accommodates a fuel supply tube 27 which extends along the bag, and has an inlet port opening in a gauze filter 28. A spirally wound wire spacer 29 extends around the filter and tube inside the bag to prevent the bag seating on the filter and sealing the inlet port when the bag is collapsed.

The tube connecting the fuel tank to the engine incorporates rigid portions 27*a*, 27*b*, each of which is connected to a housing 27*c* incorporating a non-return valve: as illustrated the valves are ball valves, but other forms, for example flap valves may be used. The housings are connected by a deformable tube 27*d*.

The valves prevent surging in the fuel flow line, and the deformable tube acts as a fuel injector for starting purposes, since it may be squeezed to force fuel into the engine.

Figure 3 illustrates the tool in elevation with a shell 12 and certain other parts removed. The casing as seen in Figure 3 houses an internal combustion engine of the two-stroke compression ignition crankcase induction type having a single air-cooled cylinder 30 and a centre-piston for adjusting the compression ratio controlled by a screw 31 accessible through a hole 32 in the casing.

Fuel is inducted into the crankcase under the control of a crank-driven disc valve via an induction pipe 33 from a main fuel pipe 34 (Figures 2 and 3) and via a needle valve controlled by a lever 35 (Figure 1). Air is inducted at the same time through a pipe 36 which extends through the casing above the fuel tank, and the air supply is controlled by a choke tube 37 which can be adjusted by a lever 38 (Figure 1). Hence, the three variables for efficient starting and running, i.e. compression ratio, fuel supply and air supply, can all be adjusted from the exterior of the casing.

Exhaust gas from the engine passes into a manifold 39 and to a silencer or expansion chamber 40 held in the casing by a screw 41 and emerges via a tail pipe 42 tapped into a hole 43 in the silencer.

The engine is carried in the casing by an engine bearer piece 44 held to the shells by screws 45 (Figure 1) passing through holes 46 (Figure 3) in the bearer piece. The engine main shaft or output shaft 47 extends through crankcase extensions 48 and into the front housing where it is splined, as seen in Figure 5. Intermediate the splines and crankcase it is fast with a multi-bladed impeller fan 49, a flywheel 50, and passes through a starter device.

The starter device (Figures 3, 4, 6 and 7) comprises a pinion 51 held on a bearing sleeve 52 by a circlip 53 and fast with a driving disc 54 loose in a starter housing 55. The flywheel 50 carries a number of pawls 56 freely rotatable on the flywheel and engaging in the pinion teeth. Each pawl is urged into this engagement by an associated torsion spring 57 anchored as a stop 58 on the flywheel. The driving disc 54 is fast with a pulley 59, and wound about the pulley is a stranded wire cable extending from a stop 61, Figure 4, clockwise about the pulley, out through a tangential guide 62 on the housing 55, and terminating in a ring or hook 63. The pulley is anchored to

a clock-spring 64, Figures 6 and 7, which extends around the sleeve 52 anti-clockwise and is anchored to the sleeve.

Hence, when the hook 63 is pulled away from the shells, the pulley is turned and rotates the driving disc so as to turn the pinion and hence the engine shaft. At the same time the clock spring is wound up, and when the hook is released, this re-winds the cable, unwinds the spring, and turns the pinion past the pawls. The turning of the engine shaft is for starting the engine. When the latter is running, the pawls slip over the pinion teeth, and may be carried out of engagement with the pinion by centrifugal force, until they abut the spring stops 58.

The output shaft 47 is splined at its end (Figure 5) as previously mentioned, and meshes with a first gear pinion 65 meshed with a reduction gear train 66, 67; the gears are journalled in bearing plate 16, and drive the final output shaft 68 at a reduced speed. The housing 17 may be grease-tight and have an oil seal 69 associated with a final drive bearing 70, Figure 1, provision for lubrication being made by screw 71, Figures 1 and 5. If desired, the output shaft may drive a tool direct, or through other forms of gearing.

The engine is cooled by air induced through inlet ports 72 in the shells, which flows about the cylinder head and barrel and is discharged through outlets 73 which are adjacent the impeller 49.

The final output shaft 68 may be provided with a chuck (not shown) or any other desired coupling facilitating connection to a tool-bit or appliance.

Engine lubrication is accomplished by mixing oil with the engine fuel. A suitable fuel for starting the engine is a mixture of ether, oil and paraffin, but when hot paraffin and oil alone may be used.

WHAT I CLAIM IS:—

1. A portable self-powered pivotal grip hand tool having an output shaft adapted to be connected to any one of a range of tool-bits or appliances, comprising a casing having a handle for carrying and directing the tool, a compression-ignition two-stroke engine disposed in the casing and having its output shaft connected to the output shaft of the tool, and a fuel tank connected to the engine through a control valve.

2. A tool according to Claim 1, wherein the engine output shaft drives a reduction gear box.

3. A tool according to Claim 1, wherein the engine is air-cooled.

4. A tool according to any of Claims 1-3, wherein the fuel tank comprises a flexible and collapsible bag sealed to a connection to the engine.

5. A tool according to Claim 4, wherein the connection to the engine includes a pair of non-return valves.

6. A tool according to Claim 4, wherein the bag is housed in a comparatively rigid container vented to atmosphere.

7. A tool according to any of Claims 4-6, wherein the connection to the engine is an inlet pipe extending along the length of the bag and surrounded at least in the vicinity of an inlet port to the pipe, by a spacer baffle.

8. A tool according to any preceding claim, wherein the fuel supply to the engine is via a needle valve.

9. A tool according to any preceding claim, wherein supply of air to the engine for combustion is via a choke tube adjustable via a lever.

10. A tool according to Claim 3, and any of Claims 4-9, wherein the engine drives a cooling fan adapted to cause air flow about the engine.

11. A tool according to any preceding claim, wherein the engine is provided with a starter comprising a pinion and pawls and a pull-operated cable for rotating the engine shaft via the pinion.

12. A tool according to Claim 11, wherein the pinion is mounted on a driving disc fast with a pulley about which the cable is wound, and a clock-spring is located in the pulley for re-winding the cable.

13. A tool according to any preceding Claim, wherein a silencer or expansion chamber connected to the engine exhaust system is located in the casing.

14. A portable power-operated tool, substantially as hereinbefore described with reference to the accompanying drawings.

SHAW, BOWKER & FALKES.
Chartered Patent Agents,
Newhall Chambers,
8, Newhall Street,
Birmingham 3.
Agents for the Applicants.

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FIG.1.

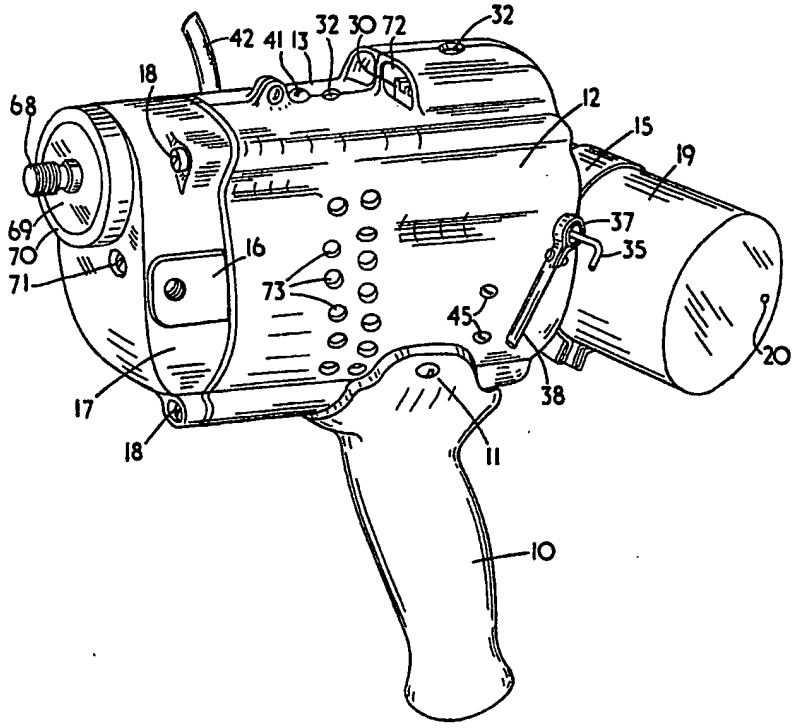
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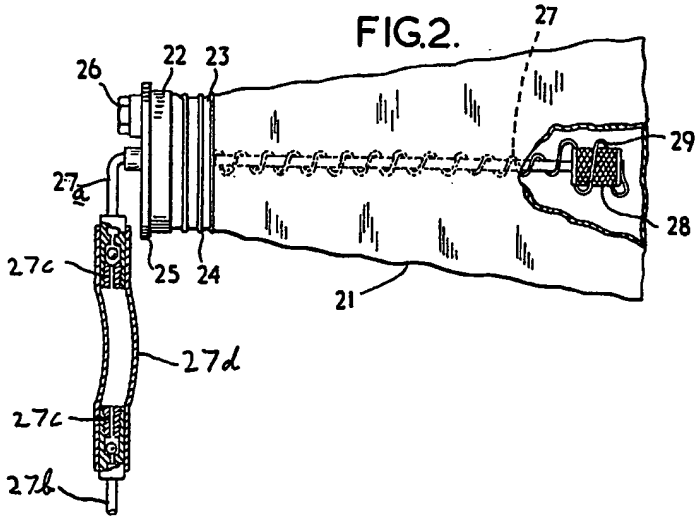
FIG.2.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27d
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2 SHEETS

COMPLETE SPECIFICATION

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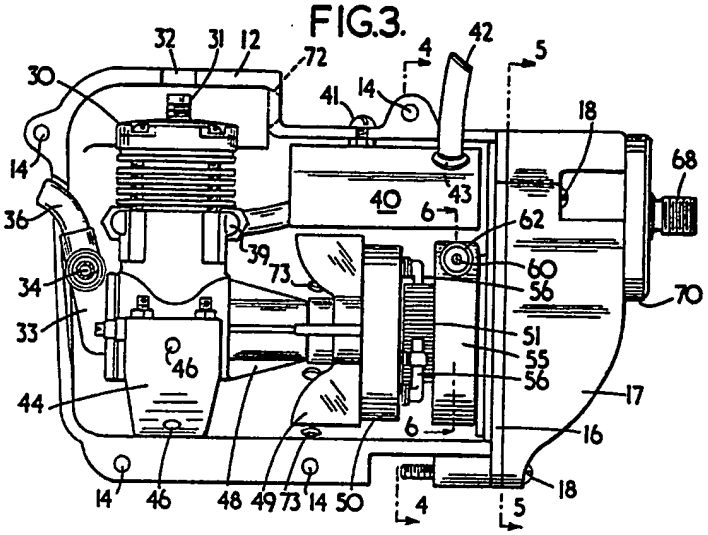
SHEETS 1 & 2

FIG.3.



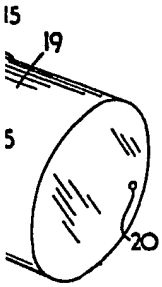


FIG.4.

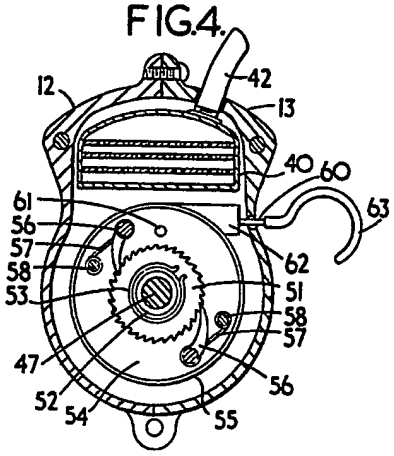


FIG.5.

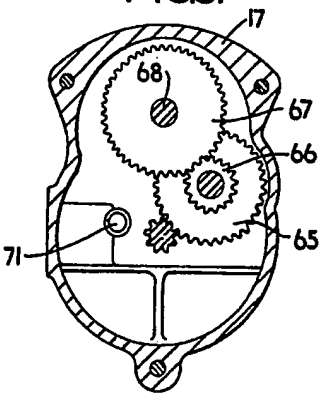


FIG.6.

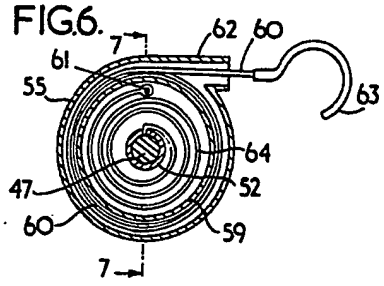
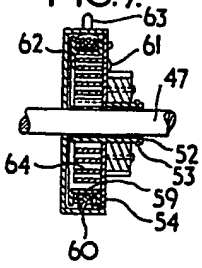


FIG.7.



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COMPLETE SPECIFICATION
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SHEETS 1 & 2

FIG.1.

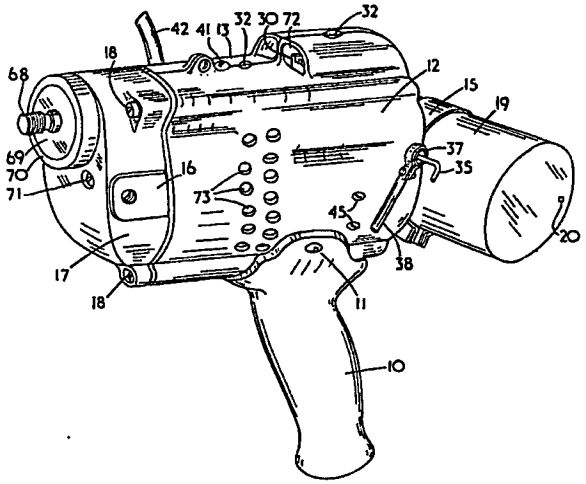

FIG.2.

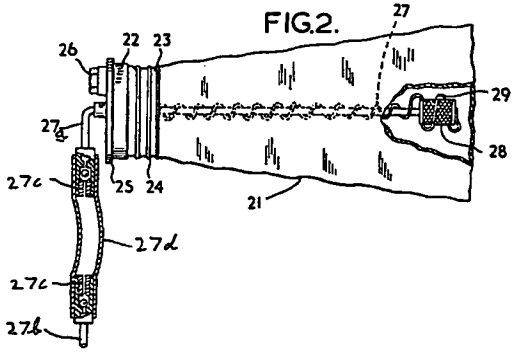

FIG.3.

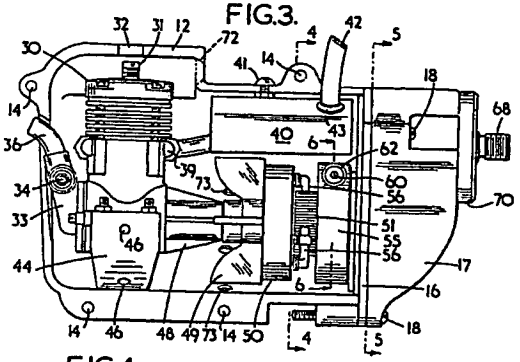

FIG.4.

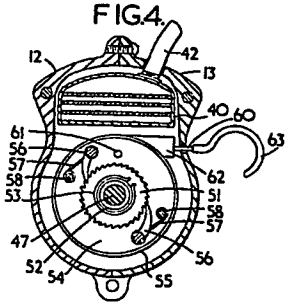

FIG.5.

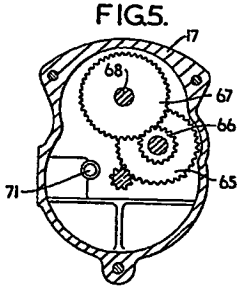

FIG.6.

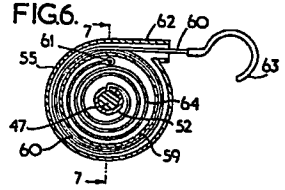

FIG.7.